Reducing Rebreathing During Noninvasive Ventilation: Bias Flow or No Bias Flow?

To the Editor:

We read with interest the article by Signori et al[1] that evaluated CO_2 rebreathing during noninvasive ventilation (NIV) via a full face mask connected to a double-limb ventilation circuit with 2 different configurations: (1) a single mask connector directly attached to the Y-piece, and (2) two separate ports for inspiratory and expiratory gas flow. The topic is important,[2-4] and the authors should be commended for their great work. To improve patient comfort, NIV can be delivered through different interfaces with different internal volumes, both for CPAP[5] and bi-level positive-pressure ventilation.[4]

So far, several studies have investigated the patient-ventilator interaction during NIV[6-8] but few addressed the problem of possible CO_2 rebreathing during NIV in configurations with either intentional (vented) or unintentional (nonvented) leaks.[9-12] We agree with the authors that the delivery of NIV by using an interface with a high internal volume, such as a full face mask, may be associated with clinically relevant CO_2 rebreathing, which would be decreased by the presence of unintentional leaks. We also agree with the results of the study that CO_2 rebreathing, which was found to be frequency-dependent, can be reduced by a mask design with separate ports for inflow and outflow during ventilation without intentional leaks.[1]

Nevertheless, this design is effective if the ventilator delivers a sufficient amount of bias flow, namely, a continuous flow circulating between the inspiratory and expiratory limbs of the respiratory circuit, independent of the inspiratory demand of the patient. The mechanism that governs CO_2 rebreathing is different between vented and nonvented NIV configurations.[12] Nonetheless, in most ventilators that use a double-limb circuit to deliver NIV, bias flow can be increased only by modifying trigger flow sensitivity, as done by the authors in the present work: reducing trigger flow sensitivity leads to higher bias flow.[1] Therefore, low inspiratory trigger sensitivity would allow a better CO_2 washout. When leaks decrease, as occurs when the mask is adjusted by the clinical staff, the patient's inspiratory effort might become insufficient to trigger the inspiratory phase, which results in missed inspiratory efforts and poor patient-ventilator interaction. This implies that the advantage of the bias flow CO_2 washout of this new mask configuration should be balanced with flow trigger sensitivity.

This is a highly relevant issue because, to the best of our knowledge, only one double-limb ventilator allows the bias flow to be set independent of the inspiratory flow-trigger setting. Thus, the clinically important message given by the authors is that it is important for manufacturers to consider the possibility of allowing the operator to set the bias flow and trigger sensitivity independently when designing new-generation mechanical ventilators. Only bench studies such as the present one can help manufacturers improve interface optimization and eventually patient-ventilator interaction.[1] So, the answer to the problem "bias flow or no bias flow" is yes, please.

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